

REMARKS

Claims 23-44 remain in this application. Non-elected claims 31-44 are withdrawn from consideration.

Applicants appreciate the clarification provided by Examiner Para in the additional Office Communication dated September 9, 2010.

CLAIM REJECTIONS - 35 USC § 103

At page 2, the Office Action rejects claims 23-30 under 35 U.S.C. § 103(a) as being unpatentable over BUEE et al. (MPMI, The American Phytopathological Society, (2000), Vol. 13(6): 693-698) in view of NAGAHASHI et al. (Mycol. Res. (2000), 104(12): 1453-1464) and SAFIR et al. (US 5,002,603) and MANGNUS et al. (J. Agric. Food Chem. (1992), 40: 1230-1235). Applicants respectfully traverse the rejection.

Claims 23-30 are directed to a method of treating arbuscular mycorrhizal (AM) fungi, comprising contacting the AM fungi with a stimulating agent in an amount that is suitable for stimulating the development and growth of the AM fungi, the stimulating agent having a structure selected from GR24, GR7, nijmegen 1, demethylsorgolactone, strigol, sorgolactone, alectrol and orobanchol. The cited references fail to teach or suggest such a method.

BUEE describes the isolation of a semipurified fraction from exudates of carrot hairy roots, highly active on germinating

spores of *Gigaspora gigantea*, *G. rosea*, and *G. margarita* (see, Abstract). The "semipurified" fraction of root exudates provided in BUEE comprises a large number of compounds. BUEE states that "these data suggested that other plant molecules, yet to be discovered, are responsible for the fungal growth stimulation and could be the plant signal needed to trigger a developmental stage in AM fungi that precedes successful root colonization." (See, page 687).

Thus, BUEE teaches to one of ordinary skill that said "other plant molecules" that are able to induce germination, growth and development of AM fungi are unknown and yet to determined. BUEE further mentions the work of GIOVANETTI et al. (New Phytol. (1996), 110: 217-225) which also concludes that the components of the branching factor were not purified and analyzed. In conclusion, the chemical structures of these components were not known or determined at the time of filing the present application.

NAGAHASHI describes "root exudates" collected from liquid culture of AM fungi host plants *Daucus carota* and *Lycopersicum esculentum*. The authors determined that the exudates stimulate hyphal branching behind the actively growing hyphal tip of three AM fungi (see, Abstract).

SAFIR discloses a method of stimulating the growth of AM fungi using isoflavonoid compounds alone or in the presence of a plant material (see, Abstract).

MANGNUS relates to the improved synthesis of strigol analogue GR24 and the evaluation of the biological activity of its diastereomers. The article evaluates the ability of the newly synthesized strigol-1 analogue (GR24) to promote the germination of seeds of two weeds - *Striga hermonthica* and *Orobanche crenata*. MANGNUS describes these plants as parasitic weeds which cause severe damage to graminaceous and luminous crops in tropical and subtropical areas (see, Introduction).

MANGNUS teaches that Strigol-1 or GR24 are both able to induce the germination of seeds and the growth of parasitic plants causing severe damage in agriculture. MANGNUS also teaches that the "suicidal germination of *Striga* and *Orobanche*, i.e. introduction of a germinating agent into soil to induce germination of the parasitic seed before the desired crop is planted, is an attractive approach for controlling weed pests" (see, Introduction).

The Office Action states that BUEE teaches "treating spores of *Gigaspora rosea* fungi with a branching factor purified from plant root exudates." The Office Action recognizes that BUEE fails to teach treating fungi spores with the strigol analogue GR24 but holds the position that it would have been obvious to modify the method of BUEE by using strigol analogue GR24, as described in MANGNUS. The Office Action contends that one of ordinary skill in the art would have been motivated to use GR24 because it is a chemical analogue of strigolactones found in

root exudate and because it is commercially available. Applicants respectfully disagree with this conclusion.

First, at the time of invention, GR24 was not commercially available. An improved method of chemical synthesis of GR24, the analogue of strigol, was successfully carried out for the first time as described in MANGNUS. The present applicants were kindly provided with a small quantity of GR24 to conduct further studies. One of ordinary skill could not have selected GR24 from among a list of equivalent compounds because GR24 was not commercially available at the time.

Second, while GR24 is a synthetic structural analogue of a strigolactone, strigolactones are only one compound from among thousands of compounds that are present in root exudates. As pointed out in the previous amendment, a non-exhaustive list of commercially available compounds which are known to be part of root exudates was provided (See, Annex I). These compounds include, for example, amino compounds, amino acids, organic acids, carbohydrates, phenol compounds, flavonoids, enzymes, nucleotides, fatty acids, and sterols, as well as more complex molecules (see, Annex I).

One of ordinary skill in the art would not have been incited to select in particular GR24 from among the laundry list of compounds which are equivalent commercially available compounds present in the root exudates. Nothing disclosed in the references or present in the knowledge of one of skill would have

led one to select the strigol analogue GR24 from among the commercially available compounds to stimulate the germination and the growth of AM fungi. Only with hindsight analysis of teachings available solely in the present specification could one draw such a conclusion.

Third, the claimed invention relates to arbuscular mycorrhizal (AM) fungi stimulating agents. As detailed in the present specification, the subject matter is based on the identification of compounds of a defined structure having the capability to stimulate the growth and development of AM fungi. One technical problem solved by the methods featured in the present claims is "to stimulate the growth and development of arbuscular mycorrhizal fungi (AM fungi)" wherein the resulting stimulation is adapted "to stimulate the mycorrhization (i.e. establishment of a symbiosis between a plant and mycorrhizal fungi) and development of plants that are valuable in agronomy and/or forestry" as a result of the benefit of the symbiosis (see, page 1, lines 6-8, of the specification). Thus, the claimed subject matter relates to stimulating the germination and growth of AM fungi.

One of ordinary skill would not have found it "obvious to select" the strigol analogue GR24, which is known to display a specific activity (stimulation of the germination and growth of seeds) in a specific technical domain (field of parasitic weeds),

to use in a method to germinate and grow spores of symbiotic AM fungi, as featured in the present claims.

Applicants also note that the families *Striga* and *Orobanche* belong to the plant kingdom, in contrast to the AM fungi featured in the present claims. One of ordinary skill in the art would not have considered the teachings of MANGNUS and the biological effect of root exudates - particularly Strigol-1 and GR24 - which applies to the growth of parasite plants *Striga* and *Orobanche*. Plants (particularly *Orobanche*) and fungi (*Mycota*) are phylogenically so far away from each other that they are classified separately into two independent Kingdoms, i.e., *Plantae*, organisms which are autotrophic according to the carbon source, and *Fungi*, organisms which are heterotrophic according to the carbon source. Also, *Striga* and *Orobanche* are parasites of plants whereas AM fungi are symbionts of plants.

For all of these reasons, one of ordinary skill in the art would not have considered the teachings of MANGNUS which describe the parasitic relation existing between plants and the *Orobanche* parasite.

Furthermore, contrary to the position taken in the Office Action, one of ordinary skill could not foresee the ability of GR24 to stimulate the germination and growth of AM fungi. The cited references fail to teach or suggest anything that would point one of skill to select and try the stigol analogue GR24 from among the large number of potential compounds.

The cited references fail to indicate that Strigol-1 or GR24, which are known for their ability to stimulate the suicidal development and growth of parasite plants, would also have stimulating properties beneficial on the development of AM fungi.

Finally, the reference teachings and the knowledge of one of ordinary skill teach away from using GR24 (known only for its ability to induce germination of parasitic weeds of *Striga* and *Orobanch*e) to induce germination of spores and the hyphal growth of fungus *Gigaspora rosea*. As detailed in the present specification, "While GR7 and GR24 have hitherto been devoted specifically and solely to the suicide germination of seeds of parasitic plants belonging to the groups *Striga* and *Orobanch*e, the invention proposes a use, hitherto unthinkable, of these molecules for their unexpected biological effect on AM fungi, microorganisms whose phylogeny is far removed from that of the plants *Striga* and *Orobanch*e".

One of ordinary skill in the art would have been dissuaded from trying GR24 to induce the beneficial germination of symbiotic AM fungi, because of the known detrimental damages caused by the weeds *Striga* and *Orobanch*e in agriculture, and the knowledge that the germination of seeds of *Striga* and *Orobanch*e can be induced by treatment of seeds with GR24.

For all of these reasons set forth in the above remarks, BUEE, NAGAHASHI, SAFIR and MANGNUS fail to teach or suggest, and would not have rendered obvious, claims 23-30.

Accordingly, Applicants request reconsideration and withdrawal of the rejection.

CONCLUSION

Entry of the above remarks is earnestly solicited. Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Should there be any matters that need to be resolved in the present application, the Examiner is respectfully requested to contact the undersigned at the telephone number listed below.

The Commissioner is hereby authorized in this, concurrent, and future submissions, to charge any deficiency or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

YOUNG & THOMPSON

/H. James Voeller/
H. James Voeller, Reg. No. 48,015
209 Madison Street
Suite 500
Alexandria, VA 22314
Telephone (703) 521-2297
Telefax (703) 685-0573
(703) 979-4709

HJV/jr